

Séminaire
Mercredi 1er Octobre 2014, 10h00
salle L. Lliboutry, LGGE

How old is the oldest meteoric ice at Vostok and what can it tell us about climate and atmospheric composition prior to 800 kyr BP?

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It is generally believed that ice older than 1 million years does exist in the East Antarctic Ice Sheet, even though this assertion has never been proved experimentally. We attempted to estimate the age of meteoric ice in the basal strata of the ice sheet near Vostok Station using the model of air-hydrate crystal growth in ice and the experimental data on the geometrical properties of the hydrate crystals.

The data show a sharp increase in the hydrate crystal size and corresponding decrease in the hydrate number concentration within the lowest about 40 meters of meteoric ice between 3500 m and 3538 m. The post-formation growth (“Ostwald ripening”) of air-hydrate crystals occurs in polar ice sheet due to diffusion of air molecules through ice matrix from hydrates of smaller size to the larger ones. To interpret the data we use a mathematical model describing the growth of air hydrates below the bubble-to-hydrate transition. Our analysis shows that the size of hydrates in the bottom part of ice sheet is a linear function of their age and that the age of air-hydrates (and that of the enclosing meteoric ice) reaches 1.5 ± 0.25 million years at the contact with the Lake Vostok accreted ice. The scale of the ice-flow disturbances in the basal strata of the glacial ice at Vostok is considered taking into account the apparently continuous increase of the hydrate crystal size with depth.

The first CO₂ and air content data obtained from the oldest meteoric ice at Vostok are discussed in the context of the scientific objectives of the Oldest

Ice Core project which is under development by the International Partnerships in Ice Core Sciences (IPICS)